

POST FOAMING COMPOSITIONS

This application is a Continuation-in-Part of my Application Serial No. 10/183985, now abandoned.

5 The present invention relates to post foaming compositions which may be kept in closed containers without producing foam, but which when released from the containers either spontaneously or with a minimal amount of rubbing on a surface will produce a gas foam.

10 Packaging exists which injects air into the contents of bottles in order to produce a temporary foam effect, but the quality of the foam produced is poor compared to other foaming methods because of the poor control and relatively large size of the bubbles so produced. Also known are
15 foaming aerosol products in which a (liquefied) propellant gas and product are intimately mixed within the aerosol can. As a result, when the actuator of the aerosol can is depressed the product emerges from the can in the form of a foam.

20 Post foaming products, which depend upon aerosol packaging, are also known. Usually, these consist of a 'bag-in-can' or piston aerosol pack in which the product is separated within the can from the propellant gas by a piston, or by being contained in an internal deformable bag.
25 Some propellant is mixed with the separated product so as to form a dispersion. Under the conditions of high pressure existing inside the can, the propellant is in a liquid state. When the product is expelled from the can by depressing the aerosol actuator, the dissolved liquid gas
30 returns to its gaseous state under the reduced pressure conditions and causes a foam to be produced by reason of the surfactant content of the aqueous phase of the product.

Such compositions are frequently used as post-foaming shave gels. The disadvantage of such products is the high internal pressures needed which necessitates the use of complex aerosol cans, which are expensive and difficult to
5 fill.

The cosmetics and household product industries, among others, would like to be able to produce post foaming products for a variety of uses but are currently unable to do so because of the cost, or where the use of metal aerosol
10 cans is considered to be inappropriate (for example, for household applications where rust or impact damage from metal and hard packaging can occur). For some applications, plastic aerosol containers could be used if the pressure needed inside the container could be substantially reduced
15 as compared to metal aerosol cans.

We have now developed post foaming compositions which are based on biliquid foam technology, which overcome the above problems and which can be packaged in strong and rigid plastic containers and which do not require the use of high
20 pressures and metal aerosol cans.

Accordingly, the present invention provides a post foaming composition which comprises an aqueous medium which includes therein:

- i) at least one primary surfactant;
- 25 ii) at least one rheology modifying agent which provides the aqueous medium with a yield value; and
- iii) a biliquid foam which comprises an aqueous medium as the continuous phase and a water-insoluble liquid having a boiling point in the
30 range of from 25 to 72°C as the internal phase;

wherein the water-insoluble liquid which is incorporated into the biliquid foam as the internal phase is chosen so that, in use, the said liquid vaporises and either spontaneously causes the composition to foam or, when the
5 composition is applied to a surface and rubbed, causes the composition to foam.

The aqueous medium of the composition contains at least one primary surfactant, or a mixture thereof, generally in an amount of at least 4% by weight, preferably
10 in an amount of from 4 to 18% by weight based on the total weight of the composition. The primary surfactant may be, for example, an alkyl ether sulphate, alkyl sulphate, alkyl olefin sulphate, sulphosuccinate, sorbitol ester or alkyl glucoside, or a mixture thereof.

15 The aqueous medium contains at least one rheology modifying agent which will generally be a polymer or a gum which will provide a yield value. The term "yield value" is an established rheological term which means that when a stress is applied to a fluid below a minimum value (yield
20 value) it exhibits a very high apparent viscosity. This means that it behaves essentially like a solid and so suspends any oil phase that may otherwise be prone to creaming. Such polymers and gums may include, but are not limited to guar gum, xanthan gum, locust bean gum,
25 aliginates and their salts, gelatin, gum acacia, hydroxymethylcellulose and its sodium salt, hydroxypropylcellulose, hydroxyethyl-cellulose carboxymethylcellulose, magnesium aluminium silicates, bentonite, salts of crosslinked polymers of acrylic acid
30 ("Carbomers"), glyceryl polymethacrylates and their dispersions in glycols, and mixtures thereof.

The aqueous medium may also contain a coactive surfactant, or a mixture thereof, generally in an amount of from 2 to 15% by weight based on the total weight of the composition. Examples of coactive surfactants for use in
5 the invention are an alkyl betaine, acylsarcinosate, ethoxylated fatty alcohol or alkylamidopropyl betaine, or mixtures thereof.

The aqueous medium may also contain a coactive rheology modifier, generally in an amount of from 0.2 to 5%
10 by weight based on the total weight of the composition. Examples of coactive rheology modifiers are an alkyl fatty acid alkanolamide, alkyl betaine, alkylamphodiacetate or alkylamphoprapionate, or mixtures thereof.

The aqueous medium may also contain any water soluble
15 or water dispersible materials commonly used in cosmetic, pharmaceutical, food and household products including glycerin, glycols such as propylene glycol, alcohols such as ethanol and propanol, water soluble humectants, conditioning agents, cooling agents, disinfecting agents, aqueous and
20 alcoholic extracts of natural plants, or water soluble or water dispersible pharmaceutically active ingredients.

The aqueous medium also contains therein a biliquid foam which comprises an aqueous medium as the continuous phase and a water-insoluble liquid having a boiling point in
25 the range of from 25° to 72°C as the internal phase. The biliquid foam is pre-prepared and is stable before being incorporated into the aqueous medium.

Biliquid foams are known in the art and are described in the following literature references by Sebba: "Biliquid
30 foams", J. Colloid and Interface Science, 40 (1972) 468-474; and "The Behaviour of Minute Oil Droplets Encapsulated in a Water Film", Colloid Polymer Sciences, 257 (1979) 392-396.

US Patent No. 4486333 to Sebba describes a particular method for the preparation of biliquid foams by agitating a hydrogen bonded liquid containing a soluble surfactant to produce a gas foam and intermittently adding to the gas foam
5 a non-polar liquid which is immiscible with the hydrogen bonded liquid, the surfactant-containing hydrogen bonded liquid being selected to provide a spreading coefficient equal to or greater than zero.

In the present invention, the biliquid foam is trapped
10 in the aqueous medium by reason of the presence of gelling or structuring materials in the aqueous phase which impart a yield value, thus preventing or inhibiting the floatation or sinking of the biliquid foam droplets. The same or additional structuring agents will also contribute to the
15 foam stability and aesthetic qualities of the product by contributing to the viscosity of the aqueous medium.

The biliquid foam will generally comprise between 1 and 80%, preferably from 3 to 10% by weight of the total formulation and the aqueous gel will comprise approximately
20 20 to 99%, and preferably from 90 to 97%.

Water-insoluble liquids which are used in the biliquid foam will in general be liquid at room temperature and have a boiling point in the range of from 25 to 72°C and preferably in the range of from 25 to 55°C. Examples of
25 suitable liquids are isohexane, methylcyclopentane, hexane, pentane, isopentane, 1-methoxy-nona-fluorobutane (HE-7100), perfluoropentane, perfluoro-N-methylmorphine or perfluorohexane or any other water insoluble liquid of suitable boiling point known in the art.

30 It will be understood that, in accordance with the present invention the selection of the water-insoluble liquid for use in the formation of the biliquid foam will

depend upon the intended manner of use and the particular application of the compositions. In order to produce a foam, the volatile liquid should be near to its boiling point at the temperature of use. Different applications may
5 have varying temperatures of use and the volatile liquid will have to be tailored to that use. For example, if the composition is to be applied to the skin, for example as a shaving foam then a liquid which will volatilise at skin temperature will be chosen. However, if the composition is
10 to be used to clean a heated surface then a liquid with a higher boiling point may be chosen.

The biliquid, foam may contain, as described a low level (e.g. from 0.05 to 5% by weight) of a surfactant which may be, for example:-

- 15 a cationic surfactant such as an amidoamine, a quaternary ammonium compound or a sulphonium salt;
 - an amphoteric surfactant such as an acylamino-acid, an N-substituted alkylamine, an N-alkyl- β -amino-propionate, an N-alkylbetaine, an alkylimidazoline or a sulphobetaine;
- 20 an anionic surfactant such as an acyl-lactate, N-acylsarcosinate, alkyl-carboxylate (either mono- or polyvalent), alkyl ether carboxylate, N-alkyl-glutamate, fatty acid-peptide condensate, phosphated ethoxylated alcohol, alkyl sulphate, ethoxylated alkyl sulphate, alpha-
25 olefin sulphonate or ester-linked sulphonate;
- a nonionic surfactant such as an alkanolamide, amine oxide, ester of a polyhydric (for example an ester of an ethylene, diethylene or propylene glycol, or glycerol or a polyglycerol, or sorbitan, glucose or sucrose), a
30 polyoxyethylene or polyoxypropylene derivative of an alcohol, amide or ester, or a polyoxyethylene/polyoxypropylene block copolymer;

or a suitable compatible mixture of these surfactants.

The continuous phase of the biliquid foam may include therein preservatives, stabilizers or other materials known in the art.

5 Methods of producing biliquid foams are described in US-A-4486333 involving the preliminary formation of a gas foam in order to provide a sufficiently large surface area on which the biliquid foam can subsequently be formed. It has been found that the prior formation of a gas foam is not
10 required to manufacture a stable biliquid foam, provided that a suitable stirring mechanism is provided in the manufacturing vessel.

 Such an apparatus comprises a tank provided with a stirrer in which the stirrer blade breaks the interface
15 between the liquid and air. A delivery device is provided through which the water insoluble liquid, which will comprise the internal phase of the dispersion, is delivered to the tank. The design of the delivery device is such that the rate of addition of the internal phase fluid can be
20 controlled and varied during the production process. A feature of the production process is that the internal phase is added to the stirred aqueous phase slowly at first until sufficient droplets have been formed to constitute a large surface area for the more rapid formation of new droplets.
25 At this point, the rate of addition of the internal phase may be increased.

 The production process consists of the following steps:

1. The addition of one or more chosen surfactants to
30 one or other or both phases (as previously determined by experiment).

2. The charging of the aqueous phase into the bottom of a process vessel.
3. The incorporation of the stirrer into the vessel so that it stirs the surface of the aqueous phase.
- 5 4. Adjustment of the stirrer speed to a previously determined level.
5. The slow addition of the internal phase whilst continuing to stir at the prescribed speed.
6. The speeding up of the rate of addition of the
10 internal phase once a prescribed amount (usually between 5% and 10% of the total amount to be added) has been added.

The stirring rate and the rate of addition of the internal phase are variables, the values of which depend
15 upon the detailed design of the manufacturing plant (in particular, the ratio of tank diameter to impeller diameter), the physico-chemical properties of the oil phase and the nature and concentrations of the chosen surfactants.

These can all be pre-determined by laboratory or pilot
20 plant experiment.

It will be understood by those skilled in the art that other manufacturing methods may be used to produce the biliquid foams, as appropriate.

The compositions of the present invention may also
25 additionally contain one or a mixture of other oils or water-insoluble liquids in the form of biliquid foams in order to modify the properties of the products (for example, to supply emollience, skin conditioning for skin care products or lubricity for shave products). For this purpose,
30 biliquid foams (additional to the low boiling point water-insoluble materials described above) typically comprising from 30 to 60% of the total product may be added and may

contain, but are not limited to the following oils which are liquid at ambient temperatures: mineral and hydrocarbon oils, dimethicones, cyclomethicones, dimethicone copolyols, emollient esters such as isopropyl palmitate, isopropyl myristate, octyl palmitate and isopropyl isostearate, oleyl alcohol, isopropyl lanolate, lanolin oil, natural oils and glycerides such as sunflower oil, avocado oil, soybean oil, coconut oil and caprylic/capric triglycerides.

The oil phase may also contain any oil-soluble or oil-dispersible materials commonly found in cosmetic and pharmaceutical products including oil soluble vitamins, emollient agents, moisturizing agents, natural oils or plant extracts and oil soluble or oil dispersible pharmaceutically active agents.

The compositions of the present invention may contain a thermal generator, either in the aqueous medium or the biliquid foam, which will generate heat on exposure to the air. Accordingly, when the composition is dispensed the thermal generator will heat the composition, thereby assisting in the evaporation and foaming of the water-insoluble liquid incorporated into the biliquid foam.

The compositions of the present invention may also contain antimicrobial agents ('preservatives') such as formalin, esters of p-hydroxybenzoic acid, imidazolidinyl urea and any other preservatives which are used in cosmetic, pharmaceutical and food products. Formulations made in accordance with the present invention may also contain antioxidants, colouring agents (food and drug or food, drug and cosmetic grade dyes and pigments), perfumes and/or flavouring agents.

The compositions of the present invention do not contain any dispensing propellant such as those used in

conventional aerosol products or in the known post foaming products. Accordingly, the compositions of the present invention may be packaged into suitable non-pressurized containers having a zero headspace provided that the
5 material from which the container is formed is impermeable to the constituents of the compositions. Suitable packaging materials may be metal, polymeric materials or laminates.

The present invention will be further described with reference to the following Example.

10 **EXAMPLE 1**

A biliquid foam was prepared from the following ingredients.

	Ingredients	Weight %
15	Aqueous Phase	
	Water	9.9
	Sodium lauryl ether sulphate	0.1
	Water-insoluble Phase	
20	Isopentane	60
	Permethyl 99A	20.2
	DC 245 fluid	8.9
	Oleth 22	0.9
	Total	100.00

25 The water-insoluble phase was prepared by compounding all of the ingredients together at a temperature of below 30°C. The water-insoluble phase was added slowly to the aqueous phase with stirring using an impeller. The process
30 was controlled so that all ingredients were maintained at below 30°C. Stirring was continued for a further 15 minutes after the addition of all of the water-insoluble phase.

Preparation of Shower Cream

	Ingredients	Weight %
	Plantapon 611	22.5
5	Structure Plus	8.1
	Emulgade CM	4.5
	Euperlan PK 4000	1.4
	Demineralised water	53.1
	Preservative (Surcide DMH)	0.4
10	and fragrance	
	Biliquid foam	10.0
	Total	100.0

The shower cream was prepared by combining all of the
15 ingredients, except for the biliquid foam, and stirring at a
temperature of below 30°C. The biliquid foam was then added
with stirring and care was taken to ensure that all
ingredients remained at below 30°C.

In use the shower cream was applied to the hands in
20 the shower, mixed with a little water from the shower outlet
and the hands then rubbed together to form a foam.

EXAMPLE 2

A biliquid foam A was prepared from the following ingredients according to the method of Example 1.

5	Ingredients	Weight %
	Aqueous Phase	
	Water	9.9
	Sodium lauryl ether sulphate	0.1
	Water-insoluble Phase	
10	Mineral Oil	89.10
	Laureth 4	0.90
	Total	100.00

A biliquid foam B was prepared from the following ingredients according to the method of Example 1

15	Ingredients	Weight %
	Aqueous Phase	
	Water	9.9
	Sodium lauryl ether sulphate	0.1
20	Water-insoluble Phase	
	Isopentane	89.10
	Oleth 2	0.90
	Total	100.00

Preparation of a Body Wash

	Ingredients	Weight %
	Aqua SF-1	5.00
	Ammonium cocoyl isothionate	2.00
5	Glycerin 917	2.00
	Cocoamidopropyl betaine	2.00
	Ammonium lauryl sulphate	7.00
	Germall plus	0.50
	Demineralised water	71.50
10	Biliquid foam A	5.00
	Biliquid foam B	5.00
	Total	100.00

The body wash was prepared by combining all of the
15 ingredients, except for the biliquid foams A and B, and
stirring at a temperature of below 30°C. The biliquid foams
A and B were added with stirring.

In use, the body wash was applied to the body and on
mixing with a little water a foam was formed.

20

Example 3

Preparation of a Foaming Hair Mousse

	Ingredients	Weight %
	Tergitol NP-10	5.00
	2-amino-2-methyl-1-propanol	0.18
5	Allianz IT-120	2.15
	2-pyrrolidone 1-ethenyl homopolymer	1.00
	Germall plus	0.50
	Aqua SF-1	3.50
10	Biliquid foam B (Example 2)	11.22
	Demineralised water	76.45
	Total	100.00

The hair mousse was prepared by combining all of the ingredients, except for the biliquid foam, and stirring at a temperature of below 30°C. The biliquid foam B was then added with stirring.

In use, the hair mousse was added to wet hair. On rubbing in to the wet hair the mousse foamed and was suitable for use in styling the hair.

Example 4

Preparation of a Foaming Hydrogen Peroxide Composition

	Ingredients	Weight %
25	Hydrogen peroxide (20 vol)	95.00
	Sodium lauryl sulphate	1.50
	Aqua SF-1	0.25
	Triethanolamine (99%)	0.25
30	Biliquid foam B (Example 2)	3.00
	Total	100.00

The hydrogen peroxide composition was prepared by adding the sodium lauryl sulphate to the hydrogen peroxide with stirring, adding the Aqua SF-1 and then neutralising with the addition of the triethanolamine, whilst continuing
5 stirring. The biliquid foam B was then added with stirring.

The product is applied to a wound on the skin to cleanse and disinfect it. On contact with the skin the product foams, allowing the peroxide to remain in contact with the wound.

10

Example 5

Preparation of a Fast Foaming Shaving Cream

	Ingredients	Weight %
15	Phase A	
	Triethanolamine (99%)	4.08
	Glycerin	4.00
	Sodium lauryl sulphate	8.17
	Sorbitol	0.81
20	Cocoamidopropyl betaine	2.45
	Aqua SF-1	6.54
	Dermacryl 79	1.63
	Demineralised water	66.56
	Phase B	
25	Stearic Acid	3.26
	Phase C	
	Biliquid foam B (Example 2)	2.00
	Germall plus	0.50
	Total	100.00

30

The ingredients for the formation of Phase A were stirred together and heated to a temperature in the range of

75° to 80°C. The molten stearic acid was added to Phase A at this temperature. The mixture was cooled to a temperature of below 30°C and the ingredients of Phase C added, with stirring.

- 5 In use the shaving cream was applied to the face in the normal manner with a wet shaving brush and lathered with a little extra water to form a foam on the face.

Example 6

10 **Preparation of a Facial Cleansing Cream**

	Ingredients	Weight %
	Ammonium lauryl sulphate	10.00
	2% Ag. soln. carbomer neutralised with	
15	triethanolamine	20.00
	2% Ag. soln. xanthan gum	5.00
	Germall Plus	0.50
	Demineralised water	30.50
	Biliquid foam A (Example 2)	30.00
20	Biliquid foam B (Example 2)	4.00
	Total	100.00

- 25 The cleansing cream was prepared by combining all of the ingredients, except for the biliquid foams A and B, and stirring at a temperature of below 30°C. The biliquid foams were then added with stirring.

The product is rubbed onto the skin forming a lather to cleanse the skin.

Example 7

Preparation of Glass and Multipurpose Cleaner

5	Ingredients	Weight %
	Propylene glycol butyl ether	4.00
	Aqua SF-1	2.00
	Alpha olefin sulphonate	0.30
	Triethanolamine (99%)	0.25
10	Demineralised water	90.45
	Biliquid foam B (Example 2)	3.00
	Total	100.00

The glass and multipurpose cleaner was prepared by
15 combining all of the ingredients, except for the biliquid
foam, and stirring at a temperature of below 30°C. The
biliquid foam was then added with stirring.

The product is sprayed onto a surface where it begins
to foam and is then wiped off to remove soil and cleanse the
20 surface.

Footnote to the Example

Trade name	Supplier	Incl Name
Permethyl 99A	Preserve	Isododecane
DC 245 fluid	Dow Corning	Cyclopentasiloxane
Plantapon 611	Cognis	Sodium laureth sulphate, water, cocamidopropyl betaine and polyglucoside
Emulgade CM	Cognis	Cetearyl isononanoate, ceteareth-20, cetearyl alcohol, glyceryl stearate, glycerin, ceteareth-12 and cetyl palmitate
Euperlan PK 4000	Cognis	Glycol distearate and laureth-4 cocamidopropyl betaine
Structure Plus	National Starch	Acrylates/aminoacrylates/C ₁₀ - 30 alkyl PEG-20 itaconate copolymer
Surcide DMH	Surety Laboratorie s	DMDH Hydantoin
Germall Plus	ISP	Diazolidinyl urea and iodopropynyl butyl carbamate
Aqua SF-1	B.F. Goodrich	Acrylate copolymer
Allianz LT- 120	ISP	Acylates C ₁₋₂ succinates, hydroxyacrylates copolymer
Dermacryl 79	National Starch	Acrylates octylacrylamide copolymer